# GPS Glossary

**2drms:** A measure of accuracy roughly equivalent to the radius of a circle centered on the true antenna position in which 95% of the GPS measurements of that position will occur. It is calculated as twice the root mean square error of the horizontal positions measured by the GPS.

**Accuracy:** The degree of conformance (agreement) between a measured position, area or other quantity obtained using GPS, and the true measure of that position or area. There are a number of measures of accuracy defined in this glossary including CEP, SEP, rms and 2drms.

**Availability:** The percentage of time that the services of a navigation system can be used within a particular coverage area. Availability is a function of both the physical characteristics of the operational environment and the technical capabilities of the transmitter facilities.

**C/A Code:** The coarse/acquisition or clear/acquisition code carried by the L1 band GPS signal. This is the GPS code that is used by civilian receivers to calculate GPS position. It was designed to provide good acquisition capabilities and repeats every millisecond.

**Carrier/ Carrier Frequency:** A carrier is a radio wave that may be modulated to carry information. The carrier frequency for the GPS C/A code is called L1 and is 1575.42 MHz.

**Channel:** A channel of a GPS receiver is the circuitry needed to receive the signal from one GPS satellite.

**Circular Error Probable (CEP):** A measure of accuracy described as the radius of a circle, centered at the true antenna position, which contains 50 percent of the points of a circular normal distribution. In other words, the radius of a circle centered on the true position that will have a 50% probability of containing a GPS measurement of that point.

**Code phase GPS:** GPS measurements made based on the C/A code.

**Control segment:** A worldwide network of GPS monitor and control stations that ensure the accuracy of the position and time of information transmitted by the GPS satellites.

**Datum:** A math model designed to fit part of the earth's surface. Latitude and longitude lines on a paper map are referenced to a specific map datum. The map datum for a GPS receiver needs to match the datum listed on the corresponding paper map.

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| Differential Positioning (DGPS): | A technique used to improve the accuracy of GPS measurements by determining the positioning error at a base station with a known location. A correction factor based on that known positioning error is then used to correct the position calculations made by another receiver operating in the same area, tracking the same satellites as the base station. The correction can be made in real time if the correction is broadcast at a later time using post-processing of stored data |
| Dilution of Precision (DOP): | A numerical description of the uncertainty of the GPS derived position based on the geometry of the satellites used. There are several variations as follows:<br>　　　　　GDOP – Geometric, 3 dimensional and clock error<br>　　　　　PDOP – Position, 3 dimensional<br>　　　　　HDOP – Horizontal, 2 dimensional, ie the lat/long error<br>　　　　　VDOP – Vertical, height only<br>　　　　　TDOP – Time, clock error only<br>　　　　　RDOP – Relative, normalized to 60 seconds |
| Elevation mask angle: | The minimum acceptable satellite elevation above the horizon to avoid blockage of line-of-sight. Some GPS units have a setting that eliminates the use of satellites that are not above a user defined elevation mask angle. |
| Ephemeris: | A list of accurate positions or locations of a celestial object over the course of time. Satellites in the GPS constellation broadcast their position based on ephemeris that is uploaded to them every 24 hours from the control stations on the earth surface. |
| Estimated Potential Error (EPE): | An estimate of horizontal position error in feet or other distance units based upon a variety of factors including DOP and satellite signal quality. |
| GPS: | The Global Positioning System. A system that is used to provide precise location based on data transmitted from a constellation of 24 satellites. |
| Ionosphere: | A portion of the earth's atmosphere located between 80 and 120 miles above the surface. This stratum is characterized by the presence of charged particles and causes the dispersion and diffraction of radio signals. |
| L-band, LI, L2: | The L-band is a group of radio frequencies extending from 390 to 1550 MHz. Both the C/A and P codes are carried on the L1 signal, 1572.42 MHz. The P code is carried on the L2 signal, 1227.60 MHz. |

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| Latitude: | The distance of a position north or south of the equator measured in degrees from 0 to 90. One minute of latitude is equal to one nautical mile. |
| Longitude: | The distance of position east or west of the prime meridian measured in degrees from 0 to 180. The ground distance associated with a degree of latitude is not constant and varies with latitude. |
| Monitor stations: | One of the worldwide stations used in the GPS control segment to track satellite clock and orbital parameters. Data collected at monitor stations are linked to a master control station at which corrections are calculated from which correction data is uploaded to the satellites as needed. |
| Multi channel receiver: | A receiver containing multiple independent channels, each of which track one satellite continuously. This allows position information to be calculated from simultaneously obtained pseudoranges. |
| Multipath: | A type of interference caused by the use of reflected GPS signals to calculate the position of a receiver. The reflected signals travel longer paths to the receiver than signals travelling directly from the satellites and therefore result in the calculation of erroneous pseudoranges. |
| Nautical Mile: | A distance equivalent to one minute of a great circle of the earth. This distance equates to 1,852 meters or approximately 6,076 feet or 1.151 statute miles. |
| Nav message: | The message broadcast by each GPS satellite. This message contains system time, clock correction parameters, ionospheric delay model parameters, and the satellite's ephemeris and health. This information is used to calculate receiver position. |
| P-code: | The precise code GPS signal used primarily by the military. The signal is encrypted with a very long and complicated code that takes the better part of a year to repeat. |
| PDOP: | A unitless figure used to describe the relationship between the receiver position error and satellite position error. The smaller the measure the better the number. PDOP is proportional to 1 divided by the area of a pyramid formed by lines drawn from the receiver to 4 satellites. Small PDOP is associated with widely spaced satellites. |
| Psuedorange: | A distance measurement between a receiver and a GPS satellite that has not been corrected for errors in synchronization between the satellite and receiver clocks. |

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| RMS: | An abbreviation for root mean squared. This description of GPS errors is used as a measure of accuracy for GPS measurements. It is calculated as the square root average of the squared errors. |
| Satellite constellation: | The arrangement in space of a group of satellites. The GPS constellation has 6 orbital planes with 4 satellites orbiting in each plane |
| Selective Availability (SA): | A Department of Defense program that degrades the positioning capability of the C/A code by introducing random errors into the satellite ephemeris and time data. SA degrades the signal to be no worse than within 100 meters 95% of the time. (This is no longer active) |
| Spherical Error Probable (SEP): | The radius of a sphere around the true antenna position within which there is a 50% probability of finding a position measured by the GPS. This is the three dimensional equivalent of CEP. |
| Standard positioning service: | The normal civilian positioning system using only the C/A code. |
| Universal Time Coordinated (UTC): | An international standard time that is kept by an atomic clock and adjusted for seasonal variations in the rotation rate of the earth. GPS time can be directly related to UTC time with an offset factor. |
| Waypoint: | A position stored in the GPS memory. Usually the location of a feature of interest or of importance to navigation. |
| Wide Area Augmentation System (WAAS): | A U.S. Federal Aviation Authority (FAA) system of equipment and software that supplements GPS accuracy, availability and integrity. The WAAS provides a satellite signal for WAAS users to support enroute and precision approach aircraft navigation. The system can be used by all users with suitable equipment to acquire positions with accuracy similar to DGPS. |
| World Geodetic System (WGS): | A description of the size and shape of the earth, based on the position of a set of points from the center of mass of the earth. The GPS system uses the WGS 84 ellipsoid as the mathematical reference for the shape of the earth. |
| Y code: | The encrypted version of the P code. |

# GPS Reference Sources

All of the training materials presented in this course as well as additional GPS information is available from the Service Center GPS website located at:

http://dc.ffasintranet.usda.gov/scgps/index.htm

This site should be available from any computer in a USDA office.


There is an abundance of information about GPS available in printed sources and especially on the Web.  Just like anything else on the Web, you have to exercise good judgement and maintain a healthy level of skepticism when deciding what to believe. The list below contains some good sites to learn more about the possibilities, limitations and technical details of GPS.

http://www.trimble.com/gps/index.htm

Trimble is a manufacturer of GPS receivers for a wide variety of applications. This site has an animated tutorial explaining how GPS works and ways to use it.

http://www.fs.fed.us/database/gps/welcome.htm

The Forest Service maintains this site with information on test results for the accuracy of specific GPS units and a variety of other GPS information.

http://sirius.chinalake.navy.mil/satpred/

The China Lake Navy base site allows a user to predict satellite coverage for any known location and time.

http://www.csi-wireless.com/support/pdfs/radiolistings.pdf

The CSI site provides an alternate site for finding the locations, frequency and bit rates for currently operating DGPS radio beacons.

http://www.gpsworld.com/

GPS World is a leading GPS industry magazine.  The web site shows current articles and reference sources.

http://www.cnde.iastate.edu/staff/swormley/gps/

This site is maintained by a member of the Iowa State University faculty and contains a wide range of information about GPS as well as a good links page.

The links that I have listed here are a very small sample of the pages that are up on the web right now.  They represent something of the range that is out there but certainly not everything that exists.  Have fun exploring!